

Determinants of Shadow Economy: Theory and Evidence

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Abstract

The goal of this paper is to develop a theory of the mechanism and determinants of why shadow economies develop and test these hypotheses using data on highly developed 21 OECD countries from 1989/90 - 2002/03. The econometric results provide support for the proposed causes for shadow economies; e.g. taxation and social security variables are found to be significant as well as the tax moral variable. Using the DYMIMIC statistical procedure the average size of the shadow economy (in % of official GDP) over 2003 of 21 highly developed OECD countries is 16.4% for 2002/03.

Key words: shadow economy, DYMIMIC, determinants of shadow economy, theoretical approach

JEL Classification: D43, D69, E41, H26, L13

1 Introduction

As underground economic activities (including shadow economy ones) are a fact of life around the world, most societies attempt to control these activities through various measures, like punishment, prostitution, economic growth and/or education. Gathering theoretical knowledge about and statistics who

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is engaged in underground activities. This theoretical and empirical knowledge about the frequencies with these activities are occurring and the magnitude of them is crucial for making effective and efficient (public) decisions regarding the allocations of a country's resources in this area. Unfortunately, it is very difficult to develop a good theoretical model and to get empirical accurate information about these underground (or as a subset shadow economy) activities on the goods and labour market, because all individuals engaged in these activities wish not to be identified. Hence, the major goal of this paper is to overcome these difficulties and in a first attempt to develop a theory of the mechanisms and determinants of why shadow economies develop and provide some empirical tests about the theoretically derived hypotheses.

The existing research has successfully established that shadow economies with illicit economic activities exist not only in non-industrialized countries but are significant also in western economies.¹ The earlier studies have analyzed in particularly two issues, i.e. payment transactions and measures of the magnitude of underground economic activities. Our paper provides a complementary study. It develops a theory of the mechanisms and determinants of why shadow economies develop and tests these hypotheses using data on OECD countries and DYMIMIC estimation method.

Some markets are prone to develop shadow transactions for the purpose of tax evasion especially if the government is viewed as a predatory revenue maximizer. Abstaining from participation of financing the public goods, those who visit the illicit market exert a negative fiscal externality on the honest consumers. However, people have intrinsic moral sentiments, with preference for obeying inherited social norms and disapproving deviants. People care what other people think of them and they are subject to self-esteem. Moral feelings of social disapproval tend to arise from free-riding by the deviants.²

Our paper raises the question what determines the borderline between legal and shadow economies. It explores to what extent moral sentiments can control shadow activities. It therefore introduces preferences for moral standards, determination of morality as social capital and sustainability of social norms when taxes can be evaded by visiting illicit markets. In the model, we consider the commodity tax in allocating consumers between the legal and illicit sectors. The paper indicates that illegal transactions are an important determinant of cash holdings despite the fact that more efficient electronic payment system are at hand.³

¹Schneider and Enste (2002).

²Fehr and Gächter (Nature 2002, 415, 137-140) indicate that people are willing to invest substantial resources in public goods, as long as they have the possibility to inflict punishment on those who free ride on the co-operation.

³Using cash for payments of illegal anonymous transactions appears as an important

In our model, morality is viewed as a network good.⁴ Apart from consumption opportunities, people value the social approval attached to their behavior within the social network sharing the same moral values. By implication, deviants subject themselves to the risk of being detected and becoming socially stigmatized. Detection is, however, probabilistic and by anonymous transactions immoral people may mimic the moral ones. Morality operates like a particular form of social capital.⁵ In our model, it is determined endogenously as the share of people who choose to commit to honest behavior.⁶

The model suggests that high tax rate, low expected cost of punishment and low relative cost of production shape the industry equilibrium leading to contraction of the legal sector and a boost in the shadow economy. To qualify, rising tax rate tends to expand the shadow economy through the tax evasion effect. There is an associated public goods effect. Moral sentiments in terms of self-esteem and disapproval of deviations from social norms operate as mechanisms which limit the shadow market activities.

The econometric and empirical results of this paper demonstrate that for the 21 highly developed OECD countries, the theoretical considerations can be confirmed: The tax and social security burden are the driving forces of the shadow economy, closely followed by the status of the official economy and by the tax morale variable. Moreover, we observe quite a dynamic increase of the shadow economy in the 90s and for a part of the OECD countries a staggering or slightly decreasing shadow economy since the end of the 90s.

Our paper is structured as follows. After surveying the previous studies

motive for why people hold cash in spite of the recent innovations in the payment system. Cash payments are convenient for those who seek to hide their motives. The markets for prostitution, for example, are presumably predominantly based on the use of cash, reducing the enforceability of within family contracts. Modern brand products like Nike or Adidas in sportswear and shoes or Prada on ladies fashion are actively copied and marketed in pirate products. With high legal prices of CDs, people have developed ability to copy music freely from internet. In construction, illegal labor is employed with the aim of tax evasion. Many private services are delivered without receipts. In most economies, there are also well-functioning secondary markets for stolen durable goods. Moreover, the rise of terrorism is largely financed by illegal money.

⁴Our model highlights the conflict between opportunistic private incentives and collective values and norms. Some studies in the sociological literature explain crimes as an outcome of evolutionary interplay between productive and expropriative strategies, cf. Cohen and Machalek (1988) and Vila and Cohen (1993).

⁵The reasons for non-opportunistic behavior have been extensively discussed by biologists. Hamilton (1964) introduced the notion of kin selection and Trivers (1971) a more general view of reciprocal altruism. Wilson (1975) represents a comprehensive document of reciprocal behavior among animals extended to human behavior by Binmore (1998). Frank (1988) argued convincingly that the ability of people to behave non-opportunistically serves as a helpful commitment device facilitating beneficial relations like joint ventures.

⁶Cf. Frank (1987) for a pioneering analysis of honesty and dishonesty.

in section 2, we develop our theoretical model in section 3. The model is estimated in section 4 which reports the empirical results. Section 5 concludes.

2 Previous Studies

Shadow Economy, its Magnitude and Payment Systems Shadow economy arises exclusively from government intervention, i.e. regulation and taxation. Such a policy intervention has side effects. Many empirical studies show that the size of the shadow economy has been most dramatic in the planned socialistic economies with maximum governmental intervention⁷. However, Giles (1999) suggests that the size of the shadow economy has been growing over the past two or three decades in almost all of the countries for which comparative data have been assembled. According to Giles, growth in the underground economy is associated with increases in the actual or perceived tax burden but also with the degree of economic regulation. The view is shared by Thomas (1999) who hints that a growing shadow economy may be an indication of over-taxation and over-regulation. He also suggests that at least some part of the shadow economy may be social security fraud, making unemployment less bad as it looks.

As early as in 1958, Cagan proposed that people prefer to use cash in illegal economy, especially in black markets and for tax evasion. Modern payment systems have sought to challenge cash, but none has been able to shake the prominent role of money. Thus, Hancock and Humphrey (1998) conclude that factors other than the simple opportunity cost must play primary role in determining holdings and the use of cash. After an extensive survey Drehman et al. (2002) conclude that 'bad behavior' creates a demand for anonymous means of payment which for now is the currency.

Some useful figures for understanding the magnitude of illegal demand for cash are provided, for example, by Rogoff (1998). Accordingly, half of the currency holdings in the OECD countries are in the domestic informal economy. It appears that informal economy already is the main holder of cash. Humphrey et al. (2000) suggest, that the technological progress will further distort the demand as the share of the legal use will decrease and the share of illegal use will increase. Thus the authorities will face an unpleasant moral dilemma, as the seigniorage revenues are likely to be due to providing the means of payment for illegal activities, for example, tax evasion!

⁷For recent survey and for methodological review see Schneider (2004).

Links to Policy There are several conclusions that have been justified in the light of the above results. Schneider (2000) gives a concerned note by suggesting that under a growing (or substantial) shadow economy, policy is based on mistaken official indicators. In addition, he suggests that a growing shadow economy attracts workers to work in shadow economy and to work less in the official economy. Giles and Caragata (1999) are concerned that unpaid tax in hidden economy or loopholes allowing abusive avoidance in the existing tax system create a deadweight loss on the economy. These will, in turn, undermine taxation equity by shifting tax burden in the direction of honest, socially responsible individuals and corporations. Accordingly, part of the hidden economy is learned response to changing opportunities and constraints in fiscal policy, but on the other hand, there is a threshold level of underground activity that will sustain.

Theoretical work Theoretical attempts to analyze the shadow economy include Cowell (1989) who asks how far should taxation authorities go in pursuit of the missing income. In a paper which is closest to ours, Acemoglu (1994) analyzes the pecuniary and non-pecuniary aspects of the reward structure on the allocation of talent across different activities with divergent private and social returns. The non-pecuniary aspects of reward structure consist of social status and prestige received for different activities. For example, the prestige and the status are influenced by the established norms and role models and reference groups⁸.

The determinants and effects of the informal sector are studied in an endogenous growth model by Loayza (1996). Using data on Latin American countries it is found that the informal sector negatively affects growth and its size depends on tax burden, labor-market restrictions and government institutions. Johnson et al. (1997) propose that supply of public goods tends to result in increasing returns in private firms, leading to multiple equilibria. Data on transition economies suggests that market-supporting institutions are critical for a successful transition. Friedman et al. (2000) suggest that the incentive to go underground to dodge higher tax rates is outweighed by the benefits of remaining official.

Camera (2001) analyzes what would happen if authorities promote the use of e-purse and limit the use of currency. Accordingly, an equilibrium exists with no illegal production if monitoring is sufficiently extensive and money supply is moderate. When enforcement is not too extensive, however, there are monetary equilibria where legal and illicit production coexist. Accordingly, the results provide a rationale for limiting the amount of cash

⁸'Bad behavior' may have less damaging stigma when it is more widespread.

in circulation. Nonetheless, using currency as an exogenous discipline on illicit undertakings may have unintended consequences, such as depressing all trading activities and decreasing welfare. Dabla-Norris and Feltenstein (2003) apply an intertemporal general equilibrium model to explore the link between tax rates, access to credit and the size of the underground economy. Simulation results for Pakistan demonstrate that entry into underground economy can have a cyclical nature. Moreover, the share of underground activity will decline over time and sectors gradually move back into legal economy. With low taxes, there is no underground economy, but due to high budget and trade deficit the low tax regime is not sustainable over time. Thus an economy may have to accept some underground activity as part of an otherwise acceptable tax program.

Davidson, Martin and Wilson (2003) suggest that shadow transactions may increase welfare. They argue in the experience goods framework that by allowing agents to self-select into the black market, the government can target tax breaks to transactions involving low-quality goods. Finally, we refer to Kanninen and Pääkkönen (2004) which provides the starting point for the model we introduce below.

3 Model

3.1 Market Solution Without Moral Sentiments: Fiscal Externality

We consider a shadow economy arising from tax evasion by consumers. Thereby, it reduces resources available for production of public goods. Our research strategy is to analyze first the industry equilibrium when one sector is taxed and the other is not. Subsequently, we introduce moral standards to examine in which way they control the development of shadow economy.

Anonymous Visits to Shadow Economy In the real world, shadow transactions take a variety of forms (Schneider and Enste (2002)), including household production, neighborhood help, sales of stolen products, imperfect reporting by firms and self-employed, gambling and drugs. It is not feasible to model all such transactions within a single paper. Instead, we formulate a model of an "industry" consisting of legal and illicit producer or services or goods, resorting to Kanninen and Pääkkönen (2004).

We thus consider a market with a product brand where a producer has market power in pricing. The product is assumed to have some prestige

value, determining the basic willingness to pay.⁹ In such markets, the entry cost is non-trivial because of the nature of the product or because of barriers to entry. The products are subject to a commodity tax, $\tau > 0$.¹⁰ Because of the market power, the producer is able to shift part of the tax to consumers. The two elements, pricing power and the tax wedge in consumer price create an incentive for illicit production. To avoid social punishment, consumers try to visit the illicit market anonymously.¹¹

Consumers Consumers are assumed to have preferences over goods and social approval. By their intrinsic preferences, people are assumed to be all alike. They are egoists in the sense of utility maximizers. But they also care for what other people think of them.¹² Thus, they have subjective preference both for their self-esteem and they care about the expected social punishment of illegal actions.¹³ Thus, morality becomes a *network phenomenon*. However, for tax evasion reasons, it may become profitable to deviate from the norm of buying only legal products. By anonymous transactions, deviants try to mimic the legal consumers, though risking themselves to social stigma. Hiding deviations from an established social norm becomes attractive, as hiding may help to maintain the status of an honest person.

We first build the market model without moral sentiments. We assume that consumers differ with respect to their willingness to pay for the prestige of the product brand. We assume that there is continuum of consumers with mass one. They can buy a private product in the legal or illicit market. We denote the producer prices by p_l, p_i . The marginal utility from buying

⁹Alternatively, we could think of paternalistically regulated industries, like casinos, state monopolies in liquor production etc.

¹⁰The possibilities to avoid the commodity tax by imperfect reporting may depend on the particular product. This observation seems to support the view that the optimal commodity tax is non-uniform, i.e. products which allow for easy tax evasion should be taxed less heavily. One topical example is the Finnish (and Swedish) tax reduction on strong liqueur, aiming at controlling the (legal and illicit) imports.

¹¹To clarify, when we talk about an illicit producer, this should not be understood to refer a registered firm but to an activity which is rival to legal activity. We also notice that we abstract from the possibility that the legal firm operates partly like an illicit producers in the shadow economy. Though such an activity is common in practice, we leave it out if only to keep the model simple enough.

¹²Such a subjective status effect is well-known in psychology, cf. Singh-Manoux, Adler and Marmot (2003). In biology, we refer to Ridley (1996). In economics, Fershtman, Weiss and Hvide (2001) have studied status effects.

¹³Binmore (1998) has shown that it is rational for people to commit to social norms and social contracts as long as the commitment gains exceed the short-term losses from deviating. Morality arises in the equilibrium of a repeated game as a social contract.

the private legal product, r^k for consumer k , is assumed to be uniformly distributed over $[0, 1]$. Consumers also value public goods. We assume that private goods and public goods are complementary and that the valuation of public goods is uniform across consumers. Complementarity implies that the marginal utility of a private good, x , for consumers is $MU_x = g > 0$. Consumers visiting the illicit market are assumed to be caught with probability $\xi > 0$ and subject to penalty $z > 0$. Consumers (k, j) visiting the legal and illicit market thus are assumed to have net utilities

$$u^k = gr^k - (1 + \tau)p_l, \quad v^j = gr^j - z\xi - p_i. \quad (1)$$

Non-excludability implies that both honest and dishonest consumers derive utility from public goods though the latter ones free-ride in the financing of those goods.¹⁴

In the industry equilibrium, we expect that there will be segmentation of markets, i.e. those consumers with high marginal utility r^k would buy the legal product while those with lower marginal utility buy the illicit product. Denote the marginal consumers by (m, n) where m is indifferent between buying the legal and illicit product while n is indifferent between buying the illicit product and buying none. Thus the marginal utility for any consumer, k , for buying the legal product is $g(1 - k)$. The marginal utility for j for buying the illicit product is $g(1 - j) - \xi z$. Insert $k = j = m$ to obtain the expressions for the marginal consumer. For indifference, $g(1 - m) - (1 + \tau)p_l = g(1 - m) - \xi z - p_i$. Note that the market share of the legal production must be $x_l = m$.

The immediate observation is that the consumer price in the legal sector has to exceed the price in the illicit sector, $(1 + \tau)p_l > p_i$. The price differential is unaffected by the valuation of public goods. Solving for the expression for the willingness to pay by the marginal consumer of the legal product from condition $\frac{g - r^m}{x_l} = g$, yields $r^m = (1 - x_l)g$. To solve for the marginal willingness to pay for the illicit product, we note that $\frac{g - r^n}{x_i + x_l} = g$, yielding $r^n = (1 - x_i - x_l)g$. Clearly, $r^m > r^n$. This implies that $r^m - (1 + \tau)p_l > 0$. By implication, the legal firm cannot exploit the full consumer surplus from its customers. Such a market power of the legal consumer arises from that she can "blackmail" the legal producer with her option to visit the illicit market. The illegal producer, in contrast, is able to exploit the full surplus from its marginal customer.

To summarize, $r^m > r^n > 0$. Then we know that all those customers with a higher product valuation than the marginal customer m will buy the legal

¹⁴The public good is more valuable to a consumer with greater willingness to pay for the private good.

product. The other active customers buy the illicit product. The third group buys nothing.

Solving for the price differential

$$(1 + \tau)p_l - p_i = \xi z. \quad (2)$$

What this condition suggests is that a consumer is indifferent between visiting the legal and illicit market if the risk of getting caught and penalized is fully compensated by the price differential. For the marginal consumer n , the net utility from buying the illicit product is zero, $g(1 - n) - \xi z - p_i = 0$. Noting that the n is the last buyer, i.e. $n = x_l + x_i$, her net utility is $(1 - x_l - x_i)g - \xi z - p_i = 0$. Thus, the valuation of public goods raises the price of the illicit product. Through the first arbitrage condition, this is then reflected in the price of the legal product, too.

The total production thus satisfies $x_l + x_i = 1 - \frac{\xi z + p_i}{g}$. Solving for the prices $p_i = (1 - x_l - x_i)g - z\xi$, $p_l = \frac{(1 - x_l - x_i)g}{1 + \tau}$.

Profits Market equilibrium can now be analyzed in terms of competition with differentiated products. The legal firm can take opportunistically advantage of honest consumers. On the other hand, the illicit market intensifies competition. This results in fewer consumers in the legal market, exerting a pressure on the legal price.¹⁵ Consumers buy the product with greater net utility.¹⁶ Under Cournot-competition in differentiated products, the behavior of firms obeys

$$\max_{x_l} (p_l - c_l)x_l, \quad \max_{x_i} (p_i - c_i)x_i, \quad (3)$$

where $c_l, c_i > 0$ are the production costs.¹⁷

Nash equilibrium In Nash equilibrium, market shares satisfy

$$x_l = \frac{g + z\xi + c_i - 2(1 + \tau)c_l}{3g} \quad (4)$$

$$x_i = \frac{g + (1 + \tau)c_l - 2z\xi - 2c_i}{3g}. \quad (5)$$

¹⁵The firm producing in the legal market obviously has an incentive to capture the consumers also in the illicit market. An example is the illegal production of pirate products of cigarettes in Eastern European countries. The legal firm typically then issues licences to combat the illegal pirate production.

¹⁶One can extend the analysis to quality uncertainty in the illicit market. One of the recent examples is the Estonian vodka. When bought in illicit markets, it has killed some consumers.

¹⁷The decision to become a producer in the illicit market could be analyzed in terms of occupational choice. Such a choice would also be subject to moral considerations which, however, will not be explicitly discussed in the current paper.

Similarly, prices are

$$p_l = \frac{g + (1 + \tau)c_l + z\xi + c_i}{3(1 + \tau)} \quad (6)$$

$$p_i = \frac{g - 2z\xi + c_i + (1 + \tau)c_l}{3} \quad (7)$$

We find that the condition for existence of shadow market in the industry equilibrium is $x_i = \frac{g + (1 + \tau)c_l - 2z\xi - 2c_i}{3g} > 0$. High tax rate and low expected cost of punishment and low relative cost of production support the development of shadow markets. In particular, increased tax on the legal product shakes the industry equilibrium leading to contraction of the legal sector and a boost in the shadow economy.

However, when tax revenue is used to finance public goods, these natural results no longer hold as their validity is limited to the *ceteris paribus* case. The role of public goods in the determination of the limits to shadow economy thus deserves attention. Solving

$$\frac{\partial x_l}{\partial g} = \frac{1}{g} \left(\frac{1}{3} - x_l \right), \quad \frac{\partial x_i}{\partial g} = \frac{1}{g} \left(\frac{1}{3} - x_i \right). \quad (8)$$

With large market shares ($x_l > \frac{1}{3}, x_i > \frac{1}{3}$), an increase in the supply of public goods reduces both the size of the legal sector and the illicit sector. It is only when the market shares are small that the complementarity effect of public and private goods raises output when more public goods become available. This somewhat surprising finding follows from the profit maximizing behavior of producers. Realizing that the willingness to pay by consumers for the private products has increased with more public goods available, producers can raise their profits by actually cutting the production and charging higher prices.

3.2 Balanced Budget Requirement

Suppose now that the public goods available are constrained by the tax revenue generated by taxation of the legal product. This amounts to considering the industry equilibrium subject to the constraint

$$g = \tau p_l x_l. \quad (9)$$

With a given tax rate, such a constraint endogenizes the supply of public goods in the economy.¹⁸ We now have five equations to determine the five

¹⁸We consider below the case where the tax rate is determined by revenue maximizing government.

variables (x_l, x_i, p_l, p_i, g) in the industry equilibrium. Dishonest people understand that by free-riding in financing the public goods production they also suffer if the tax revenue is reduced and less public goods are available. Does this understanding restrict the market share of the shadow economy? What does the uncoordinated equilibrium look like?

Suppose that there is a marginal increase in the tax rate τ . What happens to the shadow markets? From the solution above, the new industry equilibrium satisfies

$$\frac{dx_i}{d\tau} = \frac{c_l}{3g} + \left(\frac{1/3 - x_i}{g} \right) \left(\frac{dg}{d\tau} \right). \quad (10)$$

We find that if the tax rate is increased, there are two effects. The first one definitively tends to make the shadow economy larger. This can be called *the tax evasion effect* and its magnitude is measured by $c_l/3g$. High production cost in the legal sector makes the tax evasion effect large, while large supply of public goods has a negative impact on the expansion of the shadow economy. These effects follow from production decisions by firms. There is a secondary effect which depends on the impact of tax rate on tax revenue and hence on supply of public goods, $\frac{dg}{d\tau}$ and on the initial market share of the shadow economy, x_i . It is appropriate to call this *the public goods effect*. Totally differentiating the budget constraint $dg = d\tau(p_l x_l) + \tau(dp_l x_l + p_l dx_l)$ and inserting the market reactions, we find

$$\frac{dg}{d\tau} = \frac{\frac{1}{1+\tau} \left(p_l x_l - \frac{\tau c_l}{3} \left(x_l + \frac{2(1+\tau)c_l}{g} \right) \right)}{1 - \frac{1}{3} \frac{\tau}{1+\tau} x_l + \frac{\tau}{3} \frac{2\xi + c_i - 2(1+\tau)c_l}{g^2} p_l}.$$

The denominator is always positive because $\frac{1}{3} \frac{\tau}{1+\tau} x_l < 1$. The sign of numerator is, however, ambiguous. Despite its sign, $\frac{1/3 - x_i}{g}$ is positive in when shadow economy is small and negative when it is large. The public goods effect therefore generates accelerating or decelerating mechanisms on the expansion of the shadow economy when the tax rate is increased. Those mechanisms depend on the changed possibility of the legal firm to make profit when the tax rate is greater. Consider a small initial shadow economy. A sharp decline in profit $p_l x_l$ reduces access to public goods, slowing down expansion of the shadow economy. A minor decline in profit, however, makes tax revenue and hence supply of public goods sustainable. Consumers can move to the shadow economy with less concern of what happens to public goods. When the shadow economy has reached more consumers, the sign of $(1/3 - x_i)$ changes, the accelerating secondary effect disappears and the profit effect starts to decelerate. Despite such dynamic mechanisms, the

economy settles down in an equilibrium with positive tax revenue and positive supply of public goods as long as the profit of the legal firm, $p_l x_l$, does not vanish.

From a dynamic perspective, we have the following result: Rising tax rate tends to expand the shadow economy through the tax evasion effect. There is an associated public goods effect under the requirement of balanced budget, which accelerates or decelerates the expansion of the shadow economy, depending on the possibility of the legal firm to sustain profitability when the tax rate is raised.

3.3 Moral Norms in Control of Illicit Transactions

Morality as a Group Phenomenon We now introduce two mechanisms to control illicit transactions. First, we introduce moral sentiments in the values by consumers. Second, we introduce the cost of holding cash which turns out to operate analogously to the tax on legal transactions.

In addition to their basic willingness to pay, consumers are now assumed also to value self-esteem. Moreover, they are sensitive to social disapproval. In other words, they care much of what they think of themselves and what the other people think of them.¹⁹ The strength of self-esteem effect is measured by parameter $s > 0$ and it is uniform across people. Only deviants are willing to give it up.

The moral sentiments of, say poor and rich are thus equal and independent of, their incomes. The total marginal utility of consumers buying a legal product is then $gr^k + s$ and is uniformly distributed over $[s, g + s]$. Alternatively, consumers can anonymously visit the illicit market with catching-up probability ξ . If caught, they suffer from social disapproval cost, $z > 0$. The model of the previous section is now extended in that the disapproval is assumed to be expressed by those people who adhere to the social norm of visiting the legal market only. The disapproval effect thereby becomes a group phenomenon, eroding with the contraction of the legal market.²⁰ In terms of consumer valuation, the legal product thus is valued at gr^k while the illegal product is valued at $gr^k - x_l \Delta$, where Δ is the expected social

¹⁹Existence of moral sentiments has been well-known in economics ever since Adam Smith (1966) and studied more recently by Frank (1987, 1988). The origin of those sentiments has been traced both to genetic forces in evolutionary biology or to memes, cultural genes, cf. Dawkins (1976).

²⁰There is no particular need to introduce any restriction on whether it is the self-esteem or the social disapproval which has greater weight in people's valuation. The model allows for both cases.

punishment, $\Delta = E[P]$ with

$$P = \begin{cases} z & \text{with probability } \xi \\ 0 & \text{with probability } 1 - \xi. \end{cases}$$

We consider fulfilled expectations equilibrium. We assume further that payments in the illicit market are made by cash. More efficient means of payments dominate in the legal market. There is thus an extra cost of making payments in the illicit market in terms of the cost of holding cash. The cost differential is denoted by $\gamma > 0$. It would be possible to interpret the model as a cash-in-advance variety with p_i measuring the amount of cash demanded.

Consumers visiting the legal and illicit markets then have net utilities,

$$u^k = gr^k + s - (1 + \tau)p_l, \quad v^j = gr^j - x_l z \xi - (1 + \gamma)p_i. \quad (11)$$

In our model, the mass of people will be endogenously distributed into moral and immoral ones in terms of their behavior. In equilibrium people thus differ by their *factual behavior*. Moral (honest) and immoral (dishonest) *behavior* is endogenously determined and so is the strength of the social disapproval effect $x_l z \xi$. Morality as social capital is thus determined by the moral network, the expected relative size of the group of people expressing social disapproval in case of detection. The deviants²¹ are viewed as those taking the risk of being subject to stigma.²²

Denote again the marginal consumers by (m, n) where m is indifferent between buying the legal and illicit product while n is indifferent between buying the illicit product and buying none. Thus the marginal utility for any consumer, say k , for buying the legal product is $g(1 - k)$. Then the marginal utility for j for buying the illicit product is $g(1 - j) - \xi z x_l$. For the marginal consumer, her net marginal utilities have to be equal $g(1 - m) + s - (1 + \tau)p_l = g(1 - m) - \xi z x_l - (1 + \gamma)p_i$.

The price differential now satisfies $(1 + \tau)p_l - (1 + \gamma)p_i = s + \xi z x_l$. Thus, both the self-esteem effect and the group effect of moral sentiments are reflected in the price differential, as the legal producer can exploit them. For the marginal consumer n , the net utility from buying the illicit product is zero, $(1 - n)g - \xi z x_l - (1 + \gamma)p_i = 0$. Noting that the n is the last buyer, i.e. $n = x_l + x_i$, her net utility is $(1 - x_l - x_i)g - \xi z x_l - (1 + \gamma)p_i = 0$. The total production thus satisfies $x_l + x_i = g - \xi z x_l - (1 + \gamma)p_i$.

²¹The deviants might value positively other deviants, like members in gangs of sub-cultures. It would be easy to extend the model in this direction but for simplicity, we abstract from it.

²²The stigma effect has previously been discussed in psychology by Puhl and Brownell (2003) or Schulze and Angermeyer (2003).

Solving for the prices

$$p_i = \frac{(1 - x_l - x_i)g - x_l z \xi}{(1 + \gamma)}, \quad p_l = \frac{(1 - x_l - x_i)g + s}{(1 + \tau)}.$$

Nash equilibrium With reaction functions of the full model

$$x_l = \frac{g + s - (1 + \tau) c_l - x_i}{2}, \quad x_i = \frac{g - (1 + z \xi) x_l - (1 + \gamma) c_i}{2},$$

it is standard to solve for the Nash equilibrium

$$x_l = \frac{2s + g + (1 + \gamma) c_i - 2(1 + \tau) c_l}{3g - z \xi} \quad (12)$$

$$x_i = \frac{(g - z \xi) g - 2g(1 + \gamma) c_i - (g + z \xi)(s - (1 + \tau) c_l)}{(3g - z \xi) g} \quad (13)$$

$$p_l = \frac{(g + 2s + (1 + \gamma) c_i) g + (g - z \xi)(1 + \tau) c_l}{(3g - z \xi)(1 + \tau)} \quad (14)$$

$$p_i = \frac{(g - z \xi)(g + (1 + \gamma) c_i) - (g + z \xi)(s - (1 + \tau) c_l)}{(3g - z \xi)(1 + \tau)} \quad (15)$$

We comment on equilibrium below.

3.4 Competition under Morality

Comparative Statics We first develop technically the comparative static effects. Their algebra is subject to condition $g - \xi z > 0$. This condition only states the natural requirement that the expected cost of punishment cannot be greater than the maximal willingness to pay. Then, the equilibrium is characterized by the following comparative static results

Table 1 Comparative statics

	x_l	x_i	p_l	p_i
s	+	-	+	-
z	+	-	+	-
ξ	+	-	+	-
γ	+	-	+	\pm
τ	-	+	-	+
c_l	-	+	+	-
c_i	+	-	+	\pm

These results are to be discussed below.

Self-Esteem as Conscience and Social Punishment Comparative static analysis shows the potentially powerful effects of self-esteem and the risk of being caught when deviating and being punished. Those effects tend to maintain the legal sector large. Evaluating we find $\partial x_l / \partial s = \frac{2}{3g - z\xi}$. This is positive as $3g - \xi z > 0$. Self-esteem operates like a conscience for an individual, supporting the legal production. The mechanism that the social punishment effect depends on the size of the legal sector is confirmed by the result $\partial x_l / \partial z = \frac{\xi x_l}{3g - z\xi}$.

The price effects are non-trivial. This results from that the self-esteem and social disapproval effects tend to be priced not only in the illicit product. Their effect also spills over to the legal market. It is easy to see that the net surplus of the marginal consumer in the legal market is lower when he is subject to self-esteem. Insert the expressions for the quantity and price from above in the surplus of the marginal consumer, $g(1 - m) + s - (1 + \tau)p_l$ and develop the partial derivative with respect to s . This suggests that with consumers becoming more moral, they pay a price in terms of reduced surplus. The marginal consumer is now the one who previously was a shadow market visitor. They keep the option of returning to the shadow market. It is easy to see that the greater is the shadow market, the more valuable is this option. Pricing of the shadow market producer, however, reduces this option value.²³

3.5 Laffer Curve

The proponents of the view of government as revenue-maximizing Leviathan which uses resources inefficiently obviously welcome the shadow economy.²⁴ This section studies the effects of illicit transactions on an economy's Laffer-curve. Suppose that the tax revenue, T , is only partly allocated to public goods and that the government is able to extract a fraction, say $0 < y < 1$ for its own use. Then the resources available for financing public goods are

$$g = (1 - y)T.$$

Assume that the government chooses the tax rate τ to maximize its tax revenue collected from the sales of the legal firm, $T = \tau p_l x_l$. We notice that

²³Despite that the equilibrium outcome is characterized by stratification of consumers, the shadow markets do not perform a screening function of people between "honest" and "dishonest" in our model, as all consumers are ex ante identical in terms their preferences for moral sentiments.

²⁴Waste of tax revenue may result, for example, from influence or bribes by powerful lobbies leading to inefficient public spending. Grossman (2002) shows that if the technology of predation is sufficiently effective in a society, then having a "king" is better for everyone even though the king maximizes the consumption of a ruling elite.

such a government profile, though a burden on tax paying honest consumers, is not necessarily detrimental to public goods production as an increase in tax revenue means also an increase in the supply of public goods. What matters is the magnitude of the fraction, y , which the government extracts. We assume that y is constant. Then maximization of $(1 - y)T$ is equivalent to maximizing T . Kanninen and Pääkkönen (2004) have shown that with low (positive) tax rates, tax revenue (Laffer curve) is increasing in the tax rate. Thus, the Laffer curve is increasing in the tax rate when the tax rate is low. They also prove that the legal sector disappears at a certain tax rate and that the Laffer curve has a unique maximum.

As τ_3 positively depends on public goods, self-esteem, the cost of legal production, the cost of holding money and negatively on the cost of legal production, so does presumably the tax rate τ^* .

4 Econometric Analysis

4.1 Method

Causal models which incorporate latent variables have been utilized in estimating the size of the shadow economy by Giles (1999) and Schneider (2000) in cross-country data. The latent variables are not directly observable, but have operational implications for relationships among observable variables. The observable variables appear as causes of the latent variables as well as indicators of latent variables. In this paper we apply MIMIC (multiple indicators, multiple causes) method introduced by Zellner (1970) and Jöreskog and Goldberger (1975).

It is assumed that the latent variable y^* is determined by a set of observable exogenous causes x_1, \dots, x_k and a disturbance ϵ

$$y^* = \alpha_1 x_1 + \alpha_2 x_2 + \dots + \alpha_k x_k + \epsilon.$$

The latent variable, on the other hand, with disturbances u_1, \dots, u_m determines the set of observable indicators y_1, \dots, y_m

$$y_1 = \beta_1 y^* + u_1, \dots, y_m = \beta_m y^* + u_m.$$

In vector-form

$$y^* = \alpha'x + \epsilon, \tag{16}$$

$$y = \beta y^* + u, \tag{17}$$

with $E[\epsilon u'] = 0'$, $E(\epsilon^2) = \sigma^2$ and $E(uu') = \Theta^2$.

Substituting (16) to (17) the reduced-form relation is

$$y = \beta(\alpha'x + \epsilon) + u = \Pi'x + v,$$

where the reduced-form coefficient matrix is

$$\Pi = \alpha\beta',$$

and the reduced-form disturbance vector,

$$v = \beta\epsilon + u,$$

has covariance matrix

$$\Omega = E(vv') = \sigma^2\beta\beta' + \Theta^2.$$

Estimation of structural parameters is obtained through maximum likelihood, making use of the restrictions implied in both the coefficient matrix Π and the covariance matrix of the error term v . The idea of MIMIC model is that the latent variable accounts completely for the intercorrelations of the indicators. Once the effects of the causal variables x and the disturbance of ϵ on each of the indicators are removed, there is no correlation among indicators.

4.2 Hypotheses and Data

The previous theory section suggests that the extent and development of the shadow market transactions are linked to the following mechanisms and variables:

1. Tax rates

We hypothesize: The higher the share of direct and indirect taxation, the higher is the shadow economy. We also hypothesize: The higher the share of social security contributions, the higher is the shadow economy.

2. State regulation/intervention

We hypothesize: The higher the state regulation (measured in share of public administrative employment in % of total employment), the higher is the shadow economy.

3. Tax morale

We hypothesize: The higher the tax morale the lower is the shadow economy.

4. Public goods and state transfers

We hypothesize: The higher the state transfers and/or public goods and the better the quality of these goods and transfers the lower is the shadow economy.

5. Status of the economy

The worse the economy the higher the shadow economy. This is measured here in unemployment with the hypothesis: The higher the unemployment, the higher is the shadow economy. Another variable is GDP per capita with the hypothesis: The higher the GDP per capita, the lower is the shadow economy.

6. Payment habits

We hypothesize: The higher the share of cash payments the higher is the shadow economy.

These 6 hypotheses will be tested with the help of an econometric analysis order to try to explain the size and development of the shadow economy of 21 highly industrialized OECD countries. In table 4.1 the econometric estimation using the DYMIMIC approach (latent estimation approach) is presented for the 21 industrialized and highly developed OECD countries for which we have data for four points of time: 1990/91, 1994/95, 1997/98 und 1999/2000. As cause variables we have the following ones:

- share of direct taxation (positive sign expected),
- share of indirect taxation (positive sign expected),
- share of social security contribution (positive sign expected),
- burden of state regulation (share of public administrative employment in % of total employment – positive sign expected),
- tax morale (positive sign expected),
- state transfers (per capita – negative sign expected),
- unemployment quota (positive sign expected), and
- GDP per capita (negative sign expected).

As indicator variables we have the following ones:

- employment quota (in % of population 18-64 – negative sign expected),

- average working time (per week – negative sign expected),
- annual rate of GDP (adjusted for the mean of all 22 OECD countries – negative sign expected), and
- change of currency per capita (positive sign expected).

4.3 Estimation Results

ftbpFU6.1237in7.8331in0ptDYMIMIC estimation of the Shadow Economy of 21 highly developed OECD Countries, years 1990/91, 1994/95, 1997/98, 1999/2000 and 2001/2002Figure

For 21 OECD countries the results are presented in table 4.2 from 1989/90 to 2002/03.

ftbpFU6.1187in7.8323in0ptThe Size of the Shadow Economy in OECD CountriesFigure

If we consider the empirical results of table 4.1 the estimated coefficients of all seven cause variables are statistically significant and have the theoretically expected signs. The estimated coefficients of the tax and social security burden variables are quantitatively the most important ones, followed by the tax morale variable which has the single biggest influence. Hence, the tax payers' attitude against the state institutions/government is quite important to determine whether one is engaged in shadow economy activities, or not. Also the shape of the official economy measured in unemployment and GDP per capita have a quantitative important influence on the size and development of the shadow economy of these 21 OECD countries. Turning to the four indicator variables, they all have a statistically significant influence and the estimated coefficients have the theoretically expected signs. The quantitatively most important are the unemployment quota and change of currency per capita.

For the calculation of the size and the development of the shadow economy, for the 21 OECD countries a combination of the DYMIMIC method with the currency demand method is used. Considering the latest period 2002/2003, Greece has with 28.3% of official GDP the largest shadow economy, followed by Italy with 26.2%) and Portugal with 22.3%. In the middle-field are Germany with a shadow economy of 16.8% of official GDP, followed by Ireland with 15.5% and France with 14.8% of official GDP. At the lower end are Austria with 10.8% of GDP and the United States with 8.6% of official GDP. For these OECD countries one realizes over time a remarkable increase of the shadow economies during the 90s. On average the shadow economy was 13.2% in these 21 OECD states in the year 1989/90 and it rose to 16.4% in

the year 2002/2003. If we consider the second half of the 90s, we realize that for the majority of OECD countries the shadow economy is not further increasing, even (slightly) decreasing, like for Belgium from 22.5% (1997/98) to 21.5% (2002/2003), for Denmark from 18.3% (1997/98) to 17.5% (2002/2003) or for Finland from 18.9% (1997/98) to 17.6% (2002/2003) or for Italy from 27.3% (1997/98) to 26.2% (2002/2003). For others, like Austria, it is still increasing from 9.0% (1997/98) to 10.8% (2002/2003), or Germany from 14.9% (1997/98) to 16.8% (2002/2003). Hence, one can't draw a general conclusion whether the shadow economy is further increasing or decreasing at the end of the 90s. It differs from country to country but in some countries some efforts have been made to stabilize the size of the shadow economy and in other countries (like Austria or Germany) these efforts were not successful up to the year 2003.

Summarizing, the econometric and empirical results demonstrate that for the 21 highly developed OECD countries the theoretical considerations of part 2 and 3 can be confirmed: The tax and social security burden are the driving forces of the shadow economy, closely followed by the status of the official economy and by the tax morale variable. Moreover, we realize quite a dynamic increase of the shadow economy in the 90s and for a part of the OECD countries a staggering or slightly decreasing shadow economy since the end of the 90s.

5 Final Remarks

The econometric results provide support for the proposed causes for shadow economies. Taxation and social security variables were found to be significant. As a policy implication, this finding suggests that an increase in the size of the public sector with high tax burden has side-effects: hidden economy expands. Such an implication provides support for the view that by controlling tax burden, tax competition also provides breakers for shadow economies while the tax harmonization may have the opposite effect. The econometric success with the tax moral variable in control of the shadow economy points to the importance of social capital in the society. It appears thus important to make sure that the public is informed of the link between the benefits associated with their contribution. In terms of our model, the state of the official economy is reflected in the willingness to pay function. Such effects are captured by the unemployment variable and the GDP per capita variable which both turned out to be significant. As to employment promoting policies, the social benefits may thus be greater than often thought. The significant coefficient of the the state transfer variable points to the conclusion

that the transfers operate like bribing people out of the shadow economy.

The limits to shadow economy are sensitive to economic performance of an economy. There is substantial cross-country variation in the development of the shadow economies over time. We find quite an increase of the estimated size of shadow economy in the 90s in the OECD countries. For a part of the OECD countries, there is a staggering or slightly decreasing shadow economy since the end of the 90s.

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